

OFSTEST Dataset Description

Introduction

The OFSTEST dataset represents a hypothetical area with a real-time hydrometeorological data collection network and calibrated models defined for real-time forecasting using NWSRFS. Virtually every operation available in the forecast system is included in the dataset and in many cases the various instances of a given operation exercise different options of that operation. As a result, the dataset is well suited for both testing of NWSRFS and training staff in the use of the system. It provides an effective setting for learning the inputs, outputs, options and responses of individual models and illustrates relationships between components that would be difficult to understand outside the context of a complete system.

The area represented by the dataset includes two major river systems and five river basins, which are further subdivided into 35 sub-basins. Over 100 stations are defined which report hydrometeorologic information such as precipitation, temperature, river stages and reservoir releases. To reflect the fact that most of the Segments defined at RFCs throughout the country are defined with reference to the state in which the forecast point is located, five states were defined, with the names of Segments and stations in the dataset referring to the names of the states in which they are located. The states are North Central, North East, West, South East and South West. The watersheds located in these states are generally representative of the region in the United States from which the state names are derived. In almost all cases the watershed boundaries between forecast groups lie conveniently along the state lines. Figure 1 is a map of the dataset area.

The names of the rivers, stations and forecast points are derived from names of actual rivers, stations and forecast points found in the United States. While these geographical features and locations are generally intended to reflect the characteristics of the features and locations from which their names are taken, references to these names in the following sections will be in the context of the dataset unless specifically noted otherwise.

The northern river system is the Yelloweagle and includes the Pecatonica, Pavertin and Yelloweagle River Basins. The southern river system is the Texorado and includes the Blueridge and Texorado River Basins. The two river systems make up two independent Carryover groups with a total of five forecast groups. Other features of the dataset include simulation of nine dams and reservoirs, several diversions and split flows and a dynamic routing model with a main stem and three dynamic tributaries.

Topography consistent with the drainage network and the regions represented in the dataset is also defined for the entire area. In addition to a storm event lasting several days, initial conditions for the area are defined and include snow water-equivalent and frost depth. A weather summary is also defined including temperature

sequences, wind conditions and cloud cover conditions.

Setup Sequence

The hypothetical RFC used for the dataset and its associated files is referred to as OFSTEST. The sequence required for setup of the OFSTEST dataset was designed in itself to be part of the testing features and the training exercise in the dataset. The sequence items are often broken down by forecast group, such that five steps are required for each item. This facilitates group training exercises in which one or more individuals can be assigned to each forecast group, thereby accommodating groups ranging in size from five to fifteen people. The items in the setup sequence are described briefly below:

1. Initialize USER parameters (PPINIT) - these include the RFC name, bounding latitude and longitude and various defaults including measuring units and report sorting keys.
2. Initialize stations (PPINIT) - station characteristics are defined, including name, location, elevation, type of measurements available, reporting frequency and data source, among others.
3. Compute NETWORK parameters (PPINIT) - relationships between gages are computed for purposes such as estimating missing values and checking station weights.
4. Define basin boundaries (PPINIT) - latitude, longitude coordinate pairs are entered for boundaries of individual Segments.
5. Define MAP and MAT areas (PPINIT) - associations with basin boundaries and stations are made.
6. Define Rating Curves (FCINIT) - Rating Curves are defined for each forecast point so that stage-discharge conversions can be made.
7. Define Segments (FCINIT) - All of the sub-basins and associated hydrologic model parameters are defined.
8. Define forecast groups (FCINIT) - the Segments comprising the various forecast groups are identified.
9. Define Carryover groups (FCINIT) - the forecast groups comprising the various Carryover groups are identified.
10. Determine the computational processing order (PPINIT)
11. Define forecasting defaults and options (FCINIT)
12. Parse observed data and post them to the database (SHEFPARS, SHEFPOST)
13. Run the forecast preprocessors and forecast program, saving carryover (FCST)

14. Revise various station definitions with deletions, additions and changes; Then run network (PPINIT)
15. Redefine the PORSE Segment to include simulation of the REMSE area; update the forecast group and Carryover group definitions; update the computational order, delete the discontinued station; compute network parameters (FCINIT, PPINIT)
16. Add a new station, basin boundary and MAP/MAT areas; compute network parameters; define the new CHTNC Segment; redefine the JOSNC Segment to exclude the area associated with the new CHTNC Segment; update the forecast group and Carryover group; update computational order (PPINIT, FCINIT)
17. Add, delete and update stations with predetermined weights or significance weights; recompute network parameters (PPINIT)
18. Redefine Segments with updated model parameters (FCINIT)
19. Define special forecast groups (FCINIT)
20. Parse observed data and post it to the database (SHEFPARS, SHEFPOST) - this is a repeat of step 12
21. Run the forecast preprocessors and forecast program, saving carryover and protecting the initial carryover date from being overwritten (FCST)
22. Execute daily flood forecast procedure.

Development of Observations

Another important aspect of the dataset is the development of data to simulate observations as part of the flood forecasting simulation. The observations are of two basic types: meteorological inputs such as precipitation and temperature and streamflow variables including reservoir releases and river stage. The inputs were derived from the six-hour storm isohyets developed for the dataset and interpretation of the summary weather conditions. The streamflow observations were developed by executing the models and recording the simulated values. It was necessary, however, to have these observations reflect, as much as possible, the unique characteristics of hydrologic processes which are not explicitly accounted for in the models. It was also necessary to have the observations differ from the forecast that would be generated by execution of the same models in the forecast simulation. A second version of the dataset was therefore developed to simulate observations of streamflow variables that would differ from those computed in the forecasting simulation. The second version of the dataset is the 'truth' version, referred to as OFSTRUTH. It includes two basic sources of variation from OFSTEST. The first consists of parameter and initial conditions alterations in the hydrologic models used to simulate streamflow. This may be thought of as reflecting the fact that the true hydrologic response cannot be completely characterized and that the best model parameters may not be known.

The second source of variation consists of run time modifications used to temporarily alter things such as model parameters, inputs or functions in response to hydrologic conditions that may violate the assumptions of the hydrologic models being used. For instance, the direction of storm movement and distribution of rainfall in a sub-basin may prompt a temporary change in the shape of the unit hydrograph or the presence of strong, warm wind over a snow pack may suggest an increase in the melt factor in the snow model. In the training session, forecasters attempt to identify MODs that will improve the fit between the simulated streamflow variables and the observations generated using the OFSTRUTH version of the dataset. In practice, the simulated values cannot be made to perfectly match the observations because many of the alterations to parameters and initial conditions cannot be corrected through MODs.

Description of RFC Components

The primary defining characteristics of the dataset lie in the structure of the Segments, forecast groups and Carryover groups and in the Operations Tables defined for each Segment. Figure 2 shows the Segments used in the dataset. Each Segment name is composed of five letters, with the last two letters identifying the 'state' containing the Segment outlet. The states correspond directly with forecast group boundaries as follows:

State		Forecast Group	
Name	Identifier	Description	Identifier
North Central	NC	Pecatonica River	PEC
North East	NE	Pavertin River	PAV
West	WE	Yelloweagle River	YEL
South East	SE	Blueridge River	BLU
South West	SW	Texorado	TEX

Several components are common to many of the Operations Tables. The majority of the Segments defined in the dataset include the SNOW-17 operation for modeling snow accumulation and ablation. A rainfall runoff model is required for all sub-basins to compute the runoff resulting from the rain plus melt computed by the snow model or rain provided through an MAP time series when snow is not being modeled. There are a number of operations available to model the rainfall runoff process and each one is used at least once in the dataset. The UNIT-HG operation is common to all Segments that simulate runoff from a basin. The rainfall runoff models generate a channel inflow time series which represents a basin wide runoff depth that becomes available at each time step. A unit hydrograph is required to time-distribute this runoff depth as outflow at the basin outlet. The UNIT-HG operation is the only operation that can be used to apply a unit-hydrograph to a runoff time series and generate a discharge hydrograph.

The STAGE-Q, ADJUST-Q, STAGE-Q sequence of operations is another component that often occurs near the end of the Operations Table for a Segment. This sequence is used first to compute 'observed' discharge at a gage. A Rating Curve is used to convert observations of stage to

discharge. The ADJUST-Q operation is then performed to combine the information from the observed discharge time series (which includes values only up to the present) with the simulated discharge time series (which includes forecast flows in the future). Finally, the adjusted discharge is used to compute a stage time series using the same Rating Curve as before. The new stage time series will reflect both observed values to the present and provide a forecast of future river stages.

Another component that is common to many Segments is what may be called an operational plot for a given basin. Because the PLOT-TUL operation is used by IFP to generate hydrograph plots, it is usually used to develop the operational plot. The implementation of this plot in IFP typically consists of a hyetograph of rainfall (or rain plus snowmelt) and runoff depth at the top of the display, with hydrographs of runoff components in the lower half of the display. The runoff components plotted generally consist of local area runoff time series, upstream routed flow time series and simulated, adjusted and observed total flow time series. This plot allows a forecaster to view the inputs that were combined to generate the simulated total flow and identify appropriate adjustments that might be required to improve the forecast.

Segment redefinitions occur for a number of Segments in the dataset. Some of these are included to illustrate how model parameters and options used by an operation can be changed without disrupting the continuity of model states. One of these is included in each forecast group. The other Segment redefinitions are required to change the structure of the system when dividing or combining Segments. Appendix A describes each Segment and the structure of the dataset and outlines the Operations Table for each Segment.

ofstest_dataset.wpd

Figure 2. Segments in OFSTEST

